Claims

I claim:

1. A light-weight active mirror, comprising:

a first layer having a front side and a back side;

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a second layer having a front side and a backside, the backside of the second layer faces the front side of the first layer;

a reflective surface on the front side of the second layer, the reflective surface operable to reflect desired wavelengths of electromagnetic radiation;

a plurality of electroactive actuator strips arranged between the first layer and the second layer and operable to alter a curvature of the mirror;

electrical connectors operable to cause the electroactive strips to alter the curvature of the mirror;

a plurality of stiffening elements interconnected with at least one of the first layer and the second layer and operable to stiffen the mirror; and

a plurality of shape retaining elements attached to at least one of the first layer and the second layer and operable to deploy the mirror and to bias the mirror in a desired position.

2. The mirror according to claim 1, wherein the first layer of the mirror comprises a polymer film.

3. The mirror according to claim 2, wherein the first layer of the mirror comprises a

kapton film.

4. The mirror according to claim 1, wherein the stiffening elements are arranged within the first layer.

5. The mirror according to claim 1, wherein the stiffening elements comprise carbon fiber rods.

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6. The mirror according to claim 1, wherein the stiffening elements extend substantially entirely across the mirror.

7. The mirror according to claim 1, wherein the first layer has a thickness of about 2 µm to about 10 µm.

8. The mirror according to claim 1, wherein the first layer has a thickness of about 5 µm.

9. The mirror according to claim 1, wherein the second layer comprises a polymer film.

10. The mirror according to claim 9, wherein the second layer comprises a kapton film.

11. The mirror according to claim 1, wherein the second layer has a thickness of about 1 µm to about 5 µm.

12. The mirror according to claim 1, wherein the second layer has a thickness of about 2 μm.

13. The mirror according to claim 1, wherein the shape-retaining elements comprise strips symmetrically arranged on and extending substantially entirely across the front side of the first layer.

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14. The mirror according to claim 1, wherein the shape-retaining elements comprise a shape memory alloy.

15. The mirror according to claim 14, wherein the shape memory alloy comprises NiTiNOL.

16. The mirror according to claim 1, wherein the electrical connectors comprise:

a plurality of negative electrodes attached to one of the front side of the first layer and the backside of the second layer;

a plurality of positive electrodes attached to one of the front side of the first layer and the back side of the second layer that the negative electrodes are not attached to; and

a plurality of contact pads attached to the front side of the first layer and the backside of the second layer and electrically connected to the negative electrodes and the positive electrodes.

17. The mirror according to claim 16, wherein each electroactive actuator strip contacts at least one contact pad on at least one of the top layer and the bottom layer.

18. The mirror according to claim 16, wherein the positive electrodes and the negative electrodes comprise copper.

19. The mirror according to claim 1, wherein the mirror has a thickness of about 9 μm to about 12 μm.

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20. The mirror according to claim 1, wherein the mirror has a thickness of about 12 μm.

21. The mirror according to claim 1, wherein the electroactive actuators are operable to correct induced vibration, deforming loads, phasing, and aberrations in real time.

22. The mirror according to claim 21, wherein the deforming loads comprise thermal loads.

23. The mirror according to claim 21, wherein the aberrations comprise atmospheric aberrations.

24. The mirror according to claim 21, wherein the aberrations comprise spacecraft induced vibrations.

25. The mirror according to claim 1, wherein the electroactive actuators comprise at least one of piezoelectric materials, polyvinylidene di-fluoride, copolymers of polyvinylidene di-

fluoride, lead zirconate titanate, and lead zinc niobate.

26. The mirror according to claim 1, wherein the electroactive actuators deform in response to an applied voltage an amount proportional to the applied voltage and a D-coefficient of the actuators.

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27. The mirror according to claim 1, wherein the electroactive actuators are addressable individually or in groups.

28. The mirror according to claim 1, further comprising:

a wavefront sensing system comprising a plurality of sensors attached to or in close proximity to the mirror and operable to sense an optical figure of the mirror;

signal processing controls operable to receive and process signals from the wavefront sensing system and generate signals to control the electroactive actuators; and

feedback controls operable to receive signals from the sensing system.

29. The mirror according to claim 1, wherein the mirror has an average density of about 2 to about 5 grams per cubic centimeter.

30. The mirror according to claim 1, wherein the mirror has an average density of about 2 grams per cubic centimeter.

31. The mirror according to claim 1, wherein the mirror is space-based.

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32. The mirror according to claim 1, wherein the reflective surface reflects visible light.